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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : **H04L 1/00** | **A1**

(11) International Publication Number: **WO 99/27674**

(43) International Publication Date: 3 June 1999 (03.06.99)

(21) International Application Number: PCT/US98/21603

(22) International Filing Date: 9 October 1998 (09.10.98)

(30) Priority Data:
08/974,965 20 November 1997 (20.11.97) US

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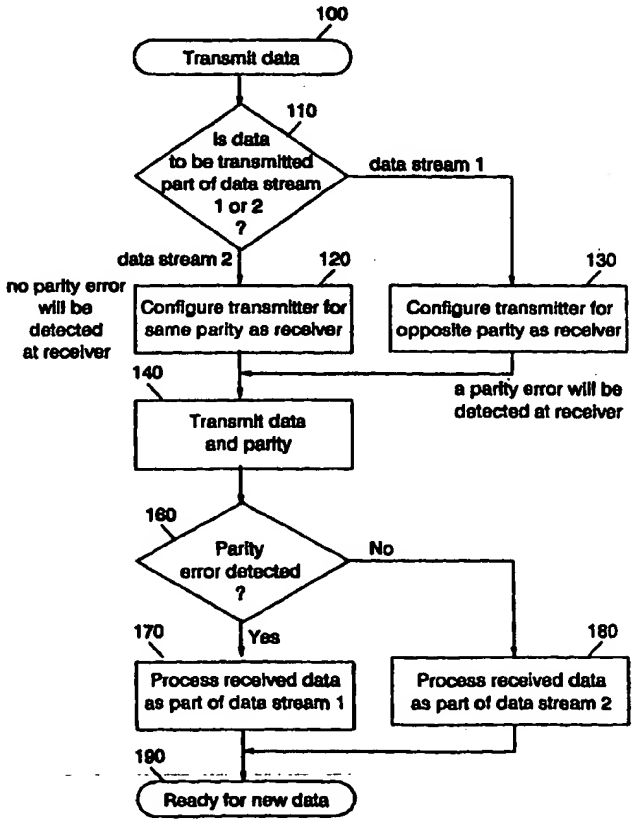
(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: METHOD AND APPARATUS USING PARITY STATUS FOR SIGNALING

(57) Abstract

A communications system for communicating a serial bit stream and parity is disclosed which enables the use of the parity bit for signaling between the transmitter and receiver by selectively inducing parity errors. The system includes a first parity generator used to generate a first parity bit on the data to be communicated. The first parity and the data are transmitted in a communications medium by a data transmitter to a data receiver. A second parity generator generates a second parity bit using the communicated data. A comparator then compares the first parity bit with the second parity bit and a parser parses the received data in response to the comparison.



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METHOD AND APPARATUS USING PARITY STATUS FOR SIGNALING

Field of the Invention

The present invention relates to communication systems and methods, in particular, to serial communications systems and methods.

Background of the Invention

Typically, serial communication systems use parity to safeguard data integrity during transmission from a transmitter to a receiver. Communications standards are used to ensure compatibility between different systems and to facilitate software development and portability. Hardware has also been developed that incorporates these standards. One such standard specifies that parity may accompany each transmission of serial data. The transmitted parity bit can then be used by the receiver to check data integrity of the serial data. This technique, however, may require additional time or

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bandwidth for data transmission because a parity bit must be added to the stream of data.

Data integrity, however, has become less of a problem in some situations. Specifically, low noise cables, system enclosures and interconnects reduce the frequency of such errors to a very low level. In other words, in some circumstances errors do not happen as frequently as had been assumed when the standards arose. Moreover, the level of protection afforded by simple parity checking generally has become inadequate for many situations that require error protection. Despite these developments, hardware and software produced today still support the standard referenced above. Parity checking, therefore, is sometimes unnecessary and goes unused in systems that support it. Consequently, the time or bandwidth allocated for transmitting the parity bit is frequently wasted.

A related problem is the need for the exchange of control messages between two asynchronous entities. For example, when a personal computer is communicating with a modem through a EIA232/V.24 cable, sometimes one entity must instruct the other entity to stop or resume sending data. This is commonly referred to as flow control. Flow control may be implemented in two ways: hardware flow control and software flow control. Hardware flow control is typically accomplished by adding wires to the cable. The additional wires carry signals dedicated to flow control. Consequently, hardware flow control may add complexity to the sending and receiving entities and the cable.

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Software flow control is usually accomplished by inserting special characters into the data stream at the transmitting entity. The receiving entity is then responsible for recognizing the special character and distinguishing it from normal data that happens to be equal to a special character. Consequently, software flow control may require additional significant software complexity on the part of the receiver.

Summary of the Invention

It is the object of the present invention to provide communications systems and methods that more efficiently utilize the bandwidth normally associated with parity checking.

It is another object of the present invention to provide communications systems and methods that exchange control messages using standard asynchronous communications hardware without significant added complexity.

Moreover, it is an object of the invention to provide communications systems and methods that use standard hardware to generate the parity bit for purposes other than checking for errors in data transmission.

These and other objects, features and advantages are provided according to the present invention by communications systems and methods which use the parity generation and checking functions typically found in standard asynchronous communications hardware to signal how transmitted data should be processed. Parity errors are forced on data transmissions that contain data that

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is to be processed in a predetermined way by a receiver if the receiver determines that a parity error exists.

Because some communication links are highly reliable and provide a very low noise environment, parity errors caused by disturbances on such links are very unlikely. Consequently, protection offered by parity often times goes unused. The present invention uses the parity bit as a signal making better use of the otherwise wasted bandwidth allocated to the parity bit in a standard serial communication system. Moreover, the meaning of the signal can be defined by the communication system employing the invention. For example, a communication system may define the parity bit as a signal to the receiver that the associated data is part of a secondary data channel or a distinct data stream. The present invention can also be practiced using commonly available components such as UARTs.

In particular, according to the present invention, a bit stream and an associated parity bit are generated. The bit stream and an associated parity bit are communicated to a receiving entity. The receiving entity performs a parity error analysis on the communicated bit stream and associated parity bit. The receiving entity then parses the communicated bit stream according to the parity error analysis.

According to another aspect of the invention, a first parity generator is used to generate a first parity bit on the data to be communicated. The first parity and the data are transmitted in a communications medium by a data transmitter to a data receiver. A second parity

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generator generates a second parity bit using the communicated data. A comparator then compares the first parity bit with the second parity bit. A parser then processes the communicated data according to the results of the comparison of the first and second parity bits.

A communications system for communicating a serial bit stream and parity according to an embodiment of the present invention includes means for generating a serial bit stream and generating associated parity. Means are provided, responsive to the parity generation means, for manipulating the generated parity. Means are provided, responsive to the manipulating means and the serial data means, for communicating the serial bit stream to the receiving entity. Means are provided, responsive to the means for communicating, for analyzing the serial bit stream and the manipulated parity for the presence of a parity error. Means are provided, responsive to the analyzing means, for parsing the communicated bit stream according to a parsing process selected based on the parity analysis. Improved data communications are thereby provided.

Brief Description of the Drawings

Some of the objects and advantages of the present invention having been stated, others will be more fully understood from the detailed description that follows and by reference to the accompanying drawings in which:

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Figure 1 illustrates a timing diagram for a serial communication system;

Figure 2 illustrates a high level block diagram showing the components in the present invention;

Figure 3 illustrates a flowchart of the operation of the present invention;

Figure 4 illustrates a flowchart of an embodiment of the present invention transmitting two logical data streams using one physical transmission link;

Figure 5A and **5B**, and **5C** illustrate a flowchart of an embodiment of the present invention transmitting N+1 bits using an N bit physical transmission link;

Figure 6A and **6B** illustrate a flowchart of a preferred embodiment of the present invention switching from normal to expanded mode; and

Figure. 7A and **7B** illustrate a flowchart of a preferred embodiment of the present invention switching from expanded to normal mode.

Detailed Description of Preferred Embodiments

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which a preferred embodiment of the invention is shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

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In general, parity ensures that the number of data bits in the logical one state transmitted across a serial transmission link is always an odd or even number, depending on how the parity generation is configured. Transmission is accomplished by merging the data to be transmitted and the proper parity into a serial bit stream and transmitting each bit for a period of time until all bits, including the parity, have been transmitted. The serial bit stream and parity are then transmitted by a transmitting entity to a receiving entity. A transmitting entity refers to the portion of the system responsible for transmitting the data. Similarly, a receiving entity refers to the portion of the system responsible for receiving the transmitted serial bit stream and parity. Those skilled in the art will appreciate that transmitting and receiving entities can be implemented in combinations of hardware and software.

Such a transmission is illustrated in **Figure 1.** Serial transmission begins with a low going pulse **71** asserted for a time t_b, representing the time used to transmit a single bit. The low going pulse **71** is used to signal the receiving entity that a stream of data will follow. Following the generation of the low going pulse **71**, the transmitting entity transmits the stream of single bits represented by Data **72**. The transmitter then transmits parity. Each data bit and the parity bit transmitted is allocated a time slot t_b. Finally, the transmitter transmits a number of high going stop bits **74** to signal the receiver that transmission is complete.

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The transmitter is then free to initiate a new transfer by transmitting a new low going pulse **75**.

A system for performing information transfers according to embodiments of the present invention is shown in **Figure 2**. Although the invention is described in terms of an eight bit serial link, the invention may also be utilized for other types of data links (*e.g.*, a parallel data link) and different size data words (*e.g.*, a seven bit data word). The The Data **5** is loaded into a Data Transmitter **10** and into a Parity Generator **20**. Parity Generator **20** generates Transmitted Parity **25** in accordance with Transmitter Parity Sense **21**. If Transmitter Parity Sense **21** indicates odd parity, parity Generator **20** generates odd parity. Otherwise, Parity Generator **20** generates even parity. Furthermore, if a Parity Error **65** is induced, Transmitter Parity Sense **21** will indicate the opposite parity as indicated by Receiver Parity Sense **52**. Once Transmitted Parity **25** is generated, Data Transmitter **10** merges Data **5** and Transmitted Parity **25** into a single serial bit stream Serial Data **15**. Serial Data **15** is then transmitted across a Transmission Link **30** according to the timing relationship described in **Figure 1**.

The portion of Serial Data **15** that represents Data **5** is loaded into a Data Receiver **40** and a Parity Generator **50**. The portion of Serial Data **15** that represents Transmitted Parity **25** is loaded into a Comparator **60**. Parity Generator **50** generates Generated Parity **55** on that portion of Serial Data **15** that represents Data **5**. Comparator **60** then compares Generated Parity **55** with that

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portion of Serial Data **15** that represents Transmitted Parity **25** and generates a Parity Error **65**. If Generated Parity **55** and Transmitted Parity **25** are the same, Parity Error **65** indicates no parity error. Otherwise Parity Error **65** indicates the presence of a parity error. Parity Error **65** indicates how Data **45** is to be parsed. A Parser **66** processes the Data **45** according to the Parity Error **65**. If the Parity Error **65** indicates a parity error, Parser **66** processes the Data **45** according to a predetermined method, producing a processed data stream **67**. If the Parity Error **65** indicates the absence of a parity error, the Parser **66** processes the Data **45** according to an alternative method.

Figures 3-7A and **7B** are flowchart illustrations of methods and apparatus for signaling with forced parity errors using commonly used hardware and communication interfaces. Those skilled in the art will understand that each block of the flowchart illustrations, and combinations of blocks in the flowchart illustrations, may be implemented with various commonly used communication system components. It will also be understood that portions of the operations described in the flowchart illustrations may be executed as computer program instructions loaded into a computer or other data processing apparatus, thus producing a machine which provides means for implementing the functions specified in the flowchart blocks and combinations thereof. The computer program may cause operational steps to be performed on the computer or data processing apparatus to produce a computer-implemented process such that the

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instructions which execute on the computer or data processing apparatus provide steps for implementing the functions of the flowchart blocks or combinations thereof. Accordingly, blocks of the flowchart illustrations support combinations of means for performing the specified functions.

In general, the means depicted in **Figures 3-7A** and **7B** may be implemented with special purpose hardware or software or firmware running on a data processing apparatus or combinations thereof. For example, the means depicted in **Figures 3-7A** and **7B** may be implemented with industry standard Universal Asynchronous Receiver Transmiter (UART) devices. Specifically, UARTs such as ones manufactured by Western Digital and others with the identification numbers 8250, 16450, and 16550 are widely available.

Figure 3 conceptually illustrates operations for transferring information according to method aspects of the present invention. The process begins with the generation of a serial bit stream including parity (Block **10**). The serial bit stream is created by separating the data bits that comprise a larger unit of data and processing each data bit individually. For example, data stored in a byte format is comprised of eight individual bits. The byte, therefore, would create a bit stream of eight bits. The parity is generated by calculating how many individual bits of the bit stream are logical ones and generating a parity bit in accordance with the parity sense being used. The invention uses the parity generation to signal how the associated bit stream should

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be parsed. The signal comes in the form of a parity error selectively induced at transmission by manipulating the parity generated for the bit stream. For example, if the bit stream data is such that it should be parsed in a particular way, the parity bit is intentionally configured to be incorrect for the associated bit stream. Consequently, a parity error will be detected at the receiving entity and the bit stream will be parsed accordingly. On the other hand, if the bit stream data is such that it should be parsed in yet a different manner, no parity error may be induced. Consequently, no parity error will be detected and the bit stream will be parsed differently.

The generated bit stream and parity are then communicated to the receiving entity (Block **20**). The communicated bit stream and parity are used to determine whether an error has occurred during communication (Block **30**). The communicated bit stream is parsed according to a predetermined process if a parity error is detected (Block **40**). If no parity error is detected, a different parsing process is used.

Figure 4, in conjunction with **Figure 2**, illustrates the operation of the present invention in a particular embodiment used for transmitting two separate data streams over a transmission link (Block **100**). Use of this embodiment makes it possible to maintain two logical data streams using one physical Transmission Link **30** (Block **110**). For example, a first data stream carrying control information could be identified by forcing a parity eror to occur on each transmission associated with that

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particular data stream. This can be done by using Transmitter Parity Sense **21** to configure the Parity Generator **20** for the opposite parity as the Parity Generator **50** (Block **130**). Similarly, a second data stream carrying digitally encoded text could be identified by associating the occurrence of no parity error with all data associated with that data stream. This can be done by configuring the Parity Generator **20** to use the same parity as the Parity Generator **50** (Block **120**). In this way, the parity associated with each data transmission is used as a signal as to how the data should be parsed.

Once the parity is configured, the data and parity are transmitted as Serial Data **15** to the receiving entity (Block **140**). Serial Data **15** is loaded into the Parity Generator **50** which then generates the Generated Parity **55**. The Comparator **60** determines whether a parity error exists by comparing the Transmitted Parity **25** to the Generated Parity **55** (Block **160**). If a parity error is detected, the received data is parsed as part of the first data stream by the Parser **66** (Block **170**). If no parity error is detected the data is parsed by the Parser **66** as part of the second data stream. The receiving entity is then ready for a new data transmission (Block **190**).

Figures. 5A, 5B, 5C, 6A, 6B, 7A and **7B**, in conjunction with **Figure 2**, illustrate operations for transmitting additional data as part of a bit stream transmitted across a transmission link according to a method aspect of the present invention. This aspect uses

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parity status to signal the transmission of data that has not been explicitly transmitted as part of the serial bit stream. In other words, the parity analysis is used as a signal to the receiving entity to alter or to add data to the bit stream received. For example, referring now to **Figure 1**, if the transmitting entity transmits eight bits of data as Data **72**, a ninth bit can be added to the transmission by selectively inducing a parity error which, by prior agreement, serves as a signal to the receiver. This can be done by generating Parity **73** to cause a mismatch with the parity generated by the receiver. The resulting parity error is interpreted by the receiver as a signal to add a ninth bit, a logical one for example, to Data **72**. Similarly, a transmission that results in no parity error can also be used, as a signal to add a logical zero as the ninth bit.

Figure 5A, **5B**, and **5C**, in conjunction with **Figure 1** and **Figure 2**, illustrate operations according to a second method aspect for transmitting additional data as part of a bit stream transmitted across the Transmission Link **30**. In the present embodiment, the invention operates in two modes. In a normal mode N bits are transmitted as Data **72** along with Parity **73**. In this mode, the parity is used to protect data integrity. In an expanded mode, N+1 bits are transmitted where N bits are transmitted as Data **72** and Parity **73** is used to signal the value of the N+1 bit.

Furthermore, the present embodiment switches or toggles between normal and expanded modes. The present embodiment uses a predetermined toggle flag to signal the

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receiver to switch modes. To switch modes, the toggle flag is transmitted by the transmitting entity to the receiving entity. The receiving entity examines all received data to determine whether the data being received is a signal to switch modes or data of the expanded data stream.

Referring now to **Figure 5A**, the transmitting entity transmits data depending upon which mode is presently active (Block **210**). If expanded mode is active, N+1 bits are processed for transmission and the parity bit is manipuluated to signal the value of the Nth+1 (Block **220**). If normal mode is active, N bits are processed for transmission and the parity bit is used as protection for the bit stream (Block **260**). Each mode of operation will now be described in detail.

In the normal mode, N bits are loaded into the Data Transmitter **10** (Block **260**) and the Parity Generator **20** (Block **270**). The Parity Generator **20** generates Transmitted Parity **25** using Transmitter Parity Sense **21**. The N bits and Transmitted Parity **25** are then transmitted across the Transmission Link **30** (Block **280**). Referring now to **Figure 5B**, the receiver checks the received data for parity error (Block **320**). Parity Generator **50** generates Generated Parity **55**, which Comparator **60** compares with Transmitted Parity **25**. If Transmitted Parity **25** matches Generated Parity **55**, neither a parity error nor a toggle flag is detected, and the receiver is ready for new data (Block **329**).

Otherwise (*i.e.*, if Transmitted Parity **25** does not match Generated Parity **55**), the receiver checks to see if

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the received data matches the toggle flag, which in the preferred embodiment is deliberately chosen to have a parity violation (for example, bit pattern 011011010 in a normal mode system operating with even parity). If the received data does not match the toggle flag (Block **325**), or if a majority of the M blocks following the first instance of the toggle flag do not match the toggle flag (Block **327**), then an error is presumed to have occurred, and appropriate error-recovery procedures outside the scope of the present invention are initiated (Block **360**). Otherwise, if the received data matches the toggle flag, and a majority of the next M blocks of the received data also match the toggle flag, the first instance of the toggle flag and the subsequent M blocks are discarded, operation shifts to expanded mode (Block **328**), and the receiver is ready for new data (Block **329**).

Now referring back to Block **220** in **Figure 5A**, in expanded mode, N+1 bits are accepted for transmission and the parity bit is used to signal the receiver as to the value of the Nth+1 bit. The Nth+1 bit is examined (Block **230**). If the Nth+1 bit is a logical zero, the Transmitter Parity Sense **21** is used to configure the Parity Generator **20** to use the same parity as the Parity Generator **50** (Block **250**). If the Nth+1 bit is a logical one, the Transmitter Parity Sense **21** is used to configure the Parity Generator **20** to use the opposite parity as the Parity Generator **50** (Block **240**). The N bits and the Transmitted Parity **25** are then transmitted across the Transmission Link **30** to the receiving entity (Block **242**).

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Referring now to **Figure 5C**, if the N+1 bits happen to equal the predetermined toggle flag, the transmitting entity must transmit otherwise redundant information, enabling the receiving entity to avoid interpreting the data as a toggle flag (Block **290**). The transmitting entity avoids this misinterpretation by adding one additional data transmission of the toggle flag when the data happens to include one or more instance of the toggle flag (Block **310**). For example, when the toggle flag appears once in the text, the transmitter sends it twice; when the toggle flag appears R consecutive times in the text, the transmitter sends it R+1 times. This repetition allows the receiving entity to assume that all data that equals the toggle flag will occur more than once in the data stream. Conversely, if the transmitting entity wishes to switch modes, the toggle flag is transmitted once (Block **300**).

If the receiver determines that the data is not equal to the toggle flag (Block **312**), the data is processed in expanded mode, following which the receiver is ready for new data (Block **370**). Otherwise (*i.e.*, the received data is equal to the toggle flag), the receiver waits for additional data before taking action. If the next data is not another toggle flag (Block **313**), operation switches from expanded mode to normal mode, the data is processed in normal mode, the earlier-received toggle flag is discarded (Block **316**), and the receiver is ready for new data (Block **370**). On the other hand, if R subsequent data blocks are equal to the toggle flag (Block **313**), then the earlier-received instance of the

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toggle flag is discarded (Block **314**), and the R data blocks, which are themselves toggle flags only by chance, are processed in expanded mode.

In expanded-mode processing, the parity of the data is examined (Block **330**). If a parity error is not evident, the N+1 bit is set to logical zero (Block **350**); if a parity error is evident, the N+1 bit is set to logical one (Block **360**).

As described above, data transmission may toggle between normal and expanded modes. The transmitting and receiving entity make a prior agreement that a particular flag will serve as the toggle flag. In the preferred embodiment, the toggle flag is constructed so as to induce a parity error in the receiver; more particularly the data word 011011010 is used. When the toggle flag is received, the receiving entity switches from its present mode of operation to the other mode as explained below. For example, if the receiver is in normal mode and receives a toggle flag, the receiver switches to expanded mode. Similarly, if the receiver receives the toggle flag while in expanded mode, the receiver will switch to normal mode.

Figures 6A and **6B**, in conjunction with **Figure 2**, further illustrate operations for switching from normal to expanded mode according to the toggling aspect (Block **400**). Referring now to **Figure 6A**, the switch from normal to expanded mode begins when the transmitting entity configures the Parity Generator **20** for the opposite parity as the Parity Generator **50** (Block **430**). The transmitting entity sends the toggle flag to the Data

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Transmitter 10 M+1 consecutive times (Block 440). The Receiver then detects the parity errors associated with the toggle flag (Block 450).

Referring now to Figure 6B, the receiving entity determines whether the data received is equal to the toggle flag (Block 460). If the received data is not equal to the toggle flag, the data is treated as part of the data stream that experienced a parity error (Block 490). If the receiving entity so provides, it may perform some level of error recovery in this case (Block 490). If the received data is equal to the toggle flag, the receiving entity accepts the next M data transmissions (Block 470) and determines whether a majority of the M data transmissions received are equal to the toggle flag (Block 480). If a majority of the M data transmission are not equal to the toggle flag (Block 480), the receiving entity concludes that the data transmissions are part of a data stream that experienced a parity error (Block 490). If a majority of the M data transmissions are equal to the toggle flag, the receiving entity concludes that the data transmissions are a toggle flag and the receiving entity switches to expanded mode (Block 500). The receiving entity then begins parsing received data streams in expanded mode (Block 510).

Figures 7A and **7B**, in conjunction with **Figure 2**, illustrate operations for switching from expanded to normal mode according to the toggling aspect (Block 600). Referring now to **Figure 7A**, switching from expanded to normal mode begins with the transmission of one toggle flag (Block 640). In the preferred embodiment, the toggle

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flag, as described above, should be selected to cause a parity error at the receiving entity. The error may be induced by mismatching the Transmitter Parity Sense **21** and the Receiver Parity Sense **52**. Mismatching the parity will ensure that a parity error will be detected, enabling the receiving entity to easily identify the switch to normal mode. The parity mismatch, however, is not a requirement to practice the invention. The toggle flag is sent once to enable the receiving entity to distinguish the toggle flag from data.

Referring now to **Figure 7B**, the receiving entity detects a parity error (Block **650**) and determines that the data received is equal to the toggle flag (Block **660**). The receiving entity waits to receive the second data transmission (Block **670**). When the second data arrives, the receiving entity determines whether the data also equals the toggle flag (Block **690**). As described above, the transmitting entity transmits toggle flags only once, while an additional instance of the toggle flag is sent when a run of data happens to equal the toggle flag. The different treatment of toggle flags and data enables the receiving entity to distinguish between a toggle flag and data that happens to equal the flag. If the second data equals the toggle flag, the data is part of a data stream. This means that the receiving entity will receive a total of R+1 toggle flag transmissions where R is equal to the number of times the toggle flag occurs in the data stream (Block **700**). For example, if the data stream contains five consecutive occurrences of data equal to the toggle flag, the

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transmitting entity will transmit the toggle flag six times. In this example, R is equal to five After receiving the initial data, the receiving entity will receive five, or R, additional occurrences. Consequently, the receiver will disregard one of the occurrences R+1 (Block **720**) which competes the transmission (Block **730**). If the second data received is not equal to the toggle flag, however, the toggle flag was intentional and the receiver switches to normal mode (Block **710**). The receiver then disregards the toggle flag which completes the switch from expanded to normal mode.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

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THAT WHICH IS CLAIMED:

1. A method of communicating information between a transmitting entity and a receiving entity, each of which are operative to communicate a bit stream that includes a parity bit for detecting errors in the bit stream, the method comprising the steps of:

generating a bit stream from the information, the bit stream including a parity bit;

communicating the generated bit stream from the transmitting entity to the receiving entity;

performing a parity error analysis on said communicated bit stream; and

parsing the communicated bit stream according to a parsing process selected based on said parity error analysis.

2. A method according to Claim 1, wherein said step of parsing comprises the steps of:

selecting a parsing process from a plurality of predetermined parsing processes based on the parity error analysis; and

parsing the communicated bit stream according to said selected parsing process.

3. A method according to Claim 2, wherein one of said parsing processes is operative to produce information from said bit stream formatted according to a bit stream format, and wherein said step of selecting a parsing process comprises the step of detecting the

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presence of a parity error in said communicated bit stream; and

wherein said step of parsing comprises the step of parsing the communicated bit stream according to said one parsing process in response to detection of a parity error in the communicated bit stream.

4. A method according to Claim 3, wherein said step of parsing comprises the step of interpreting said communicated bit stream as a control command, in response to detection of said parity error in said communicated bit stream.

5. A method according to Claim 3, wherein said step of parsing comprises generating an additional data bit in response to detection of said parity error in said communicated bit stream.

6. A method according to Claim 5, wherein said additional data bit comprises a single data bit per data word.

7. A method according to Claim 3, wherein said parity bit is configured to produce said parity error at said receiving entity wherein said step of detecting is preceded by the step of configuring the transmitting entity and the receiving entity to operate with opposite parity.

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8. A method according to Claim 3, wherein said parity bit is configured to produce said parity error at said receiving entity wherein said step of detecting is preceded by the steps of:

configuring the transmitting entity and the receiving entity to operate with identical parity; and

inverting said parity bit generated by said transmitting entity.

9. A method according to Claim 2, wherein one of said parsing processes is operative to produce information from said bit stream formatted according to a bit stream format, and wherein said step of selecting a parsing process comprises the step of detecting the absence of a parity error in said communicated bit stream; and

wherein said step of parsing comprises the step of parsing said communicated bit stream according to said one parsing process in response to said detection of the absence of a parity error in said communicated bit stream.

10. A method according to Claim 9, wherein said step of parsing comprises the step of interpreting said communicated bit stream as clear text data.

11. A method according to Claim 9 wherein said step of parsing comprises the step of generating an additional data bit in response to detection of the absence of said parity error in said communicated bit stream so as to

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expand the amount of data that may be transmitted in said communicated bit stream.

12. A method according to Claim 11, wherein said additional data bit comprises a single bit per data word.

13. A method according to Claim 2, wherein said step of parsing comprises the step of separating said communicated bit stream into two data streams based on said parity error analysis of said communicated bit stream for the presence of said parity error.

14. A method according to Claim 1, wherein said step of parsing comprises the steps of:

parsing said communicated bit stream using a first parsing process selected from said plurality of predetermined parsing processes based on said parity error analysis performed on said communicated bit stream;

detecting a toggle flag within said communicated bit stream; and

parsing a subsequent communicated bit stream using a second parsing process selected from said plurality of predetermined parsing processes based on said parity error analysis performed on said subsequent communicated bit stream.

15. A method according to Claim 14, wherein said step of detecting comprises the steps of:

determining whether said toggle flag is followed by an additional toggle flag; and

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switching said receiving entity to an expanded mode if said toggle flag is not followed by said additional toggle flag.

16. A method according to Claim 15, wherein said step of switching comprises the step of changing said parsing process in response to detecting said toggle flag so as to identify more than one logical channel.

17. A method according to Claim 16, wherein said toggle flag is configured to cause a parity error to be detected by said receiving entity.

18. A method according to Claim 1 wherein said communicating step comprises the step of communicating said generated bit stream from said transmitting entity to said receiving entity asynchronously.

19. A method according to Claim 1 wherein said step of generating comprises generating said bit stream from the information, said bit stream including eight data bits and a parity.

20. An apparatus for signaling between a plurality of communicating entities, comprising

means for generating a bit stream and parity associated with said bit stream;

means, responsive to said means for generating a bit stream, for manipulating said associated parity;

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means, responsive to said means for generating said bit stream, for communicating said bit stream and said manipulated associated parity from a transmitting entity to a receiving entity;

means, responsive to said means for communicating said bit stream and said manipulated parity, for analyzing said communicated bit stream and manipulated associated parity for the presence of a parity error by said receiving entity;

means, responsive to said means for analyzing, for parsing said communicated bit stream according to a parsing process selected based on the parity error analysis.

21. The apparatus of claim 20, wherein said means for generating a bit stream and parity associated with said bit stream comprises:

means for serializing data words stored in a computer memory;

means, responsive to said means for serializing, for performing odd and even parity calculations on said stored data words; and

means, responsive to said means for performing odd and even parity calculations on said stored data words and said means for serializing data words stored in a computer memory, for combining said serialized data words and said odd or even parity into a serialized bit stream.

22. The apparatus of Claim 20, wherein said means for manipulating comprises:

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means for storing a flag indicating that said associated parity is to be manipulated; and

means, responsive to said flag, for inverting said associated parity responsive to said flag indicating that said associated parity is to be manipulated.

23. The apparatus of Claim 20, wherein said means for manipulating comprises said transmitting entity and said receiving entity configured to generate opposite parity.

24. The apparatus of Claim 20, wherein said transmitting entity comprises a universal asynchronous receiver transmitter.

25. The apparatus of Claim 20, wherein said receiving entity comprises a universal asynchronous receiver transmitter.

26. The apparatus of Claim 20, wherein said means for parsing comprises:

a parity flag indicating the detection of a parity error within said communicated bit stream; and

a means, responsive to said parity flag, for introducing additional data into said communicated bit stream.

27. An apparatus for communicating data comprising:

a first parity generator configured to generate a first parity bit;

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a data transmitter, responsive to said first parity generator, configured to produce a bit stream including said parity bit in a communications medium;

a data receiver, responsive to said communications medium, configured to receive a bit stream;

a second parity generator, responsive to said data transmitter, configured to generate a second parity bit from said received bit stream;

a comparator, responsive to said second parity bit and said first parity bit, configured to compare said first parity bit with said second parity bit; and

a parser, responsive to said data receiver and said comparator, configured to parse said received bit stream in accord with the comparison of said first and second parity bits.

28. The apparatus of Claim 27, wherein said first parity generator may be configured independently of said second parity generator.

29. The apparatus of Claim 27, wherein said data transmitter comprises a universal asynchronous transmitter receiver.

30. The apparatus of Claim 27, wherein said transmitter and said receiver comprise a EIA232/V.24 interface.

31. The apparatus of claim 20, wherein said means for communicating said bit stream and said parity from

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said transmitting entity to said receiving entity asynchronously.

32. The apparatus of claim 20, wherein said means for generating a bit stream and parity associated with said bit stream comprises means for serializing data words stored in a computer memory into eight data bits and one parity bit.

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FIG. 1

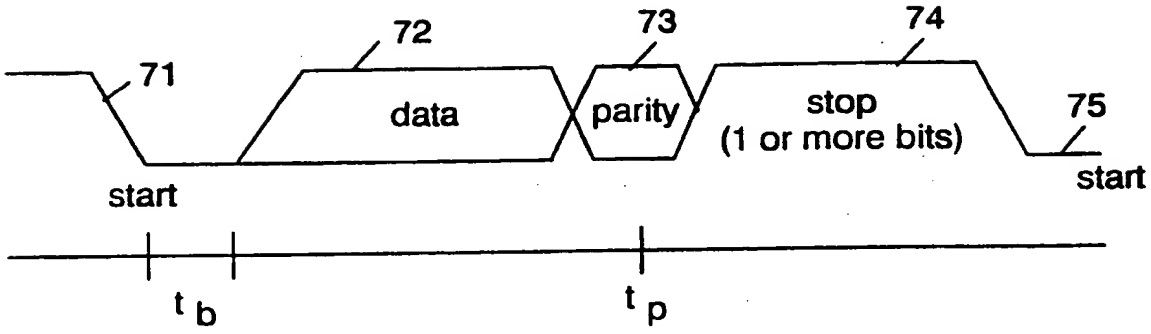
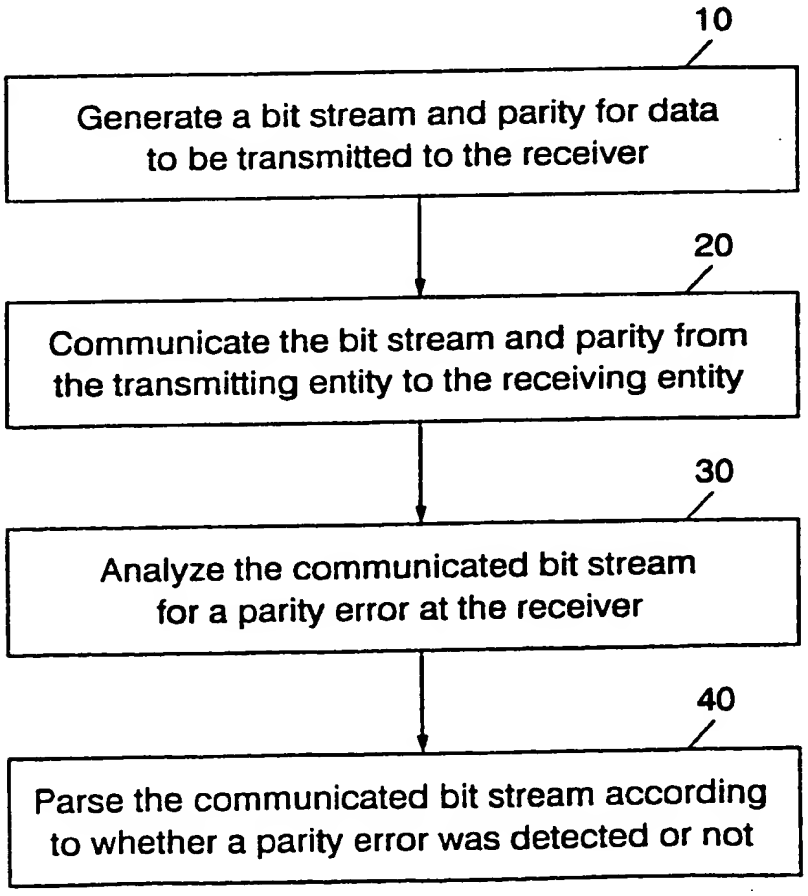


FIG. 3



BNSDOCID: <WO___9927674A1_I_>

FIG. 2

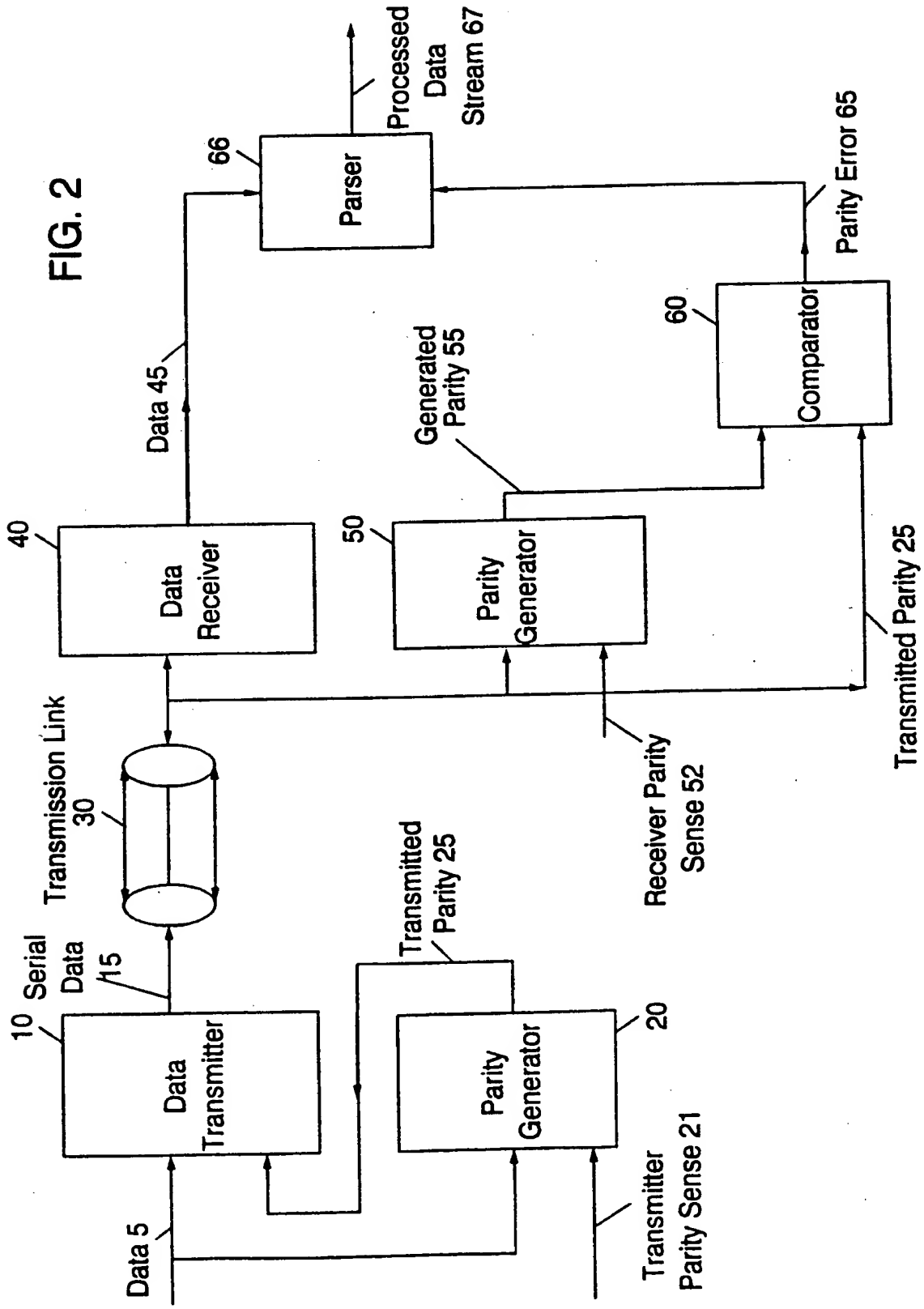


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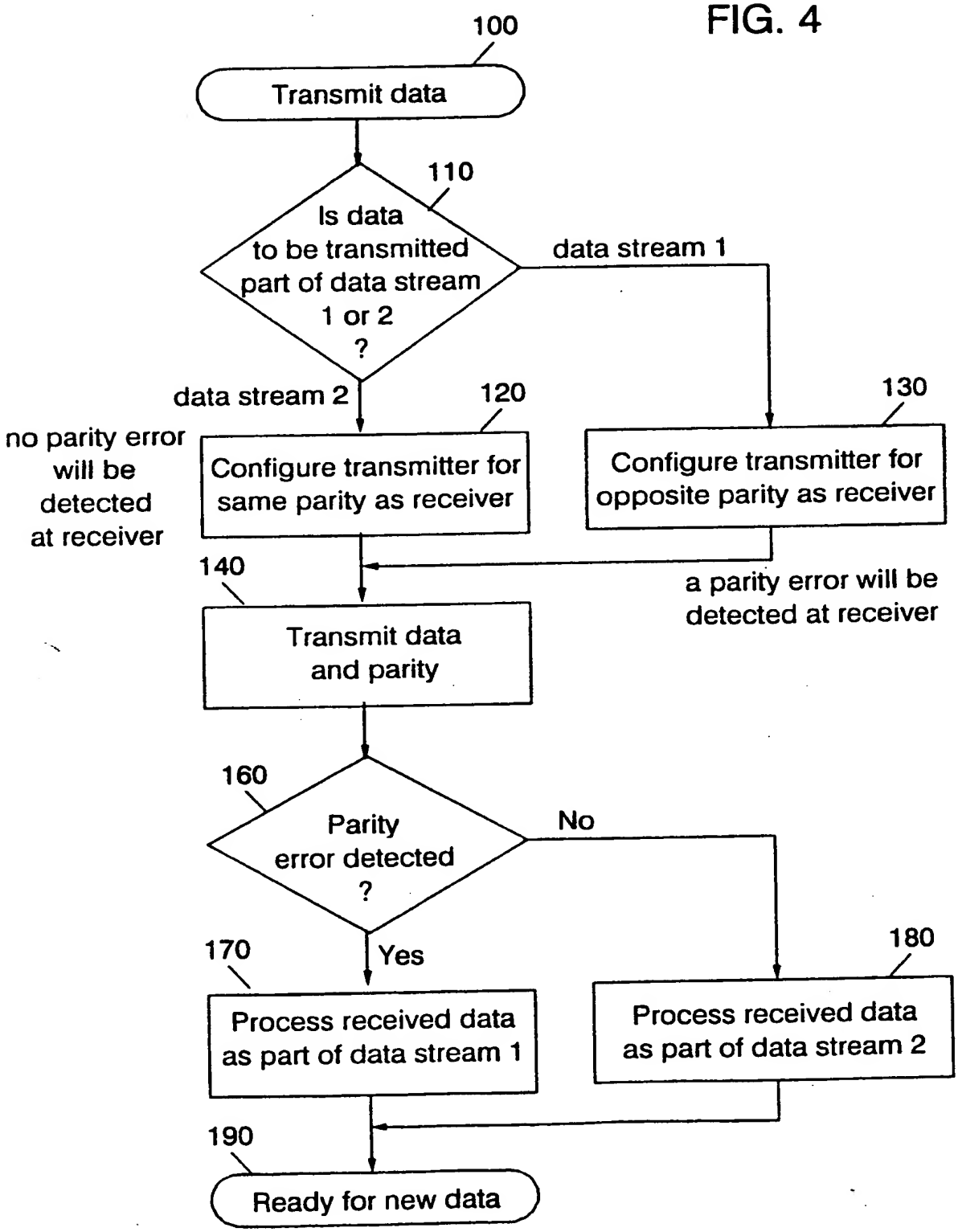
FIG. 4



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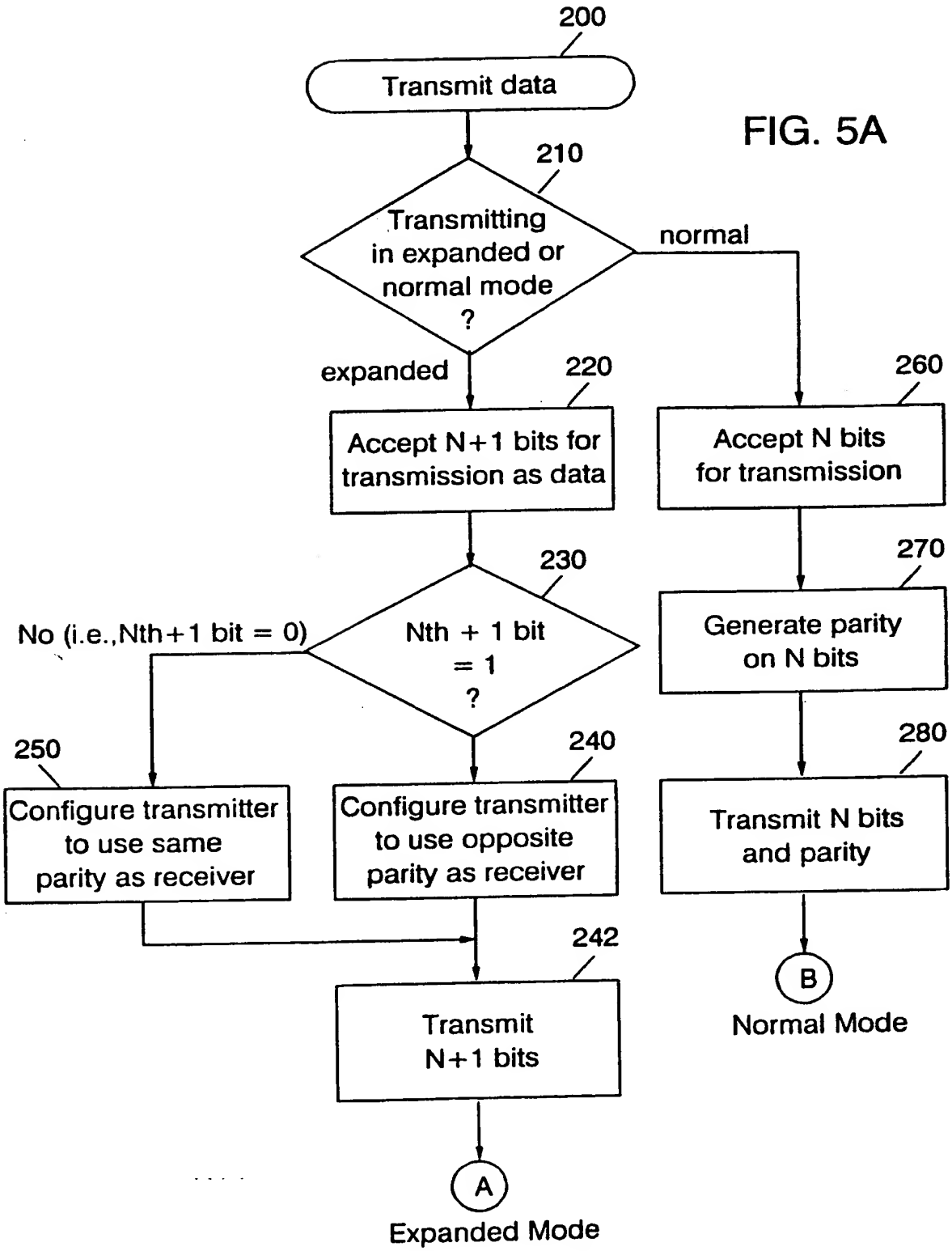

FIG. 5A

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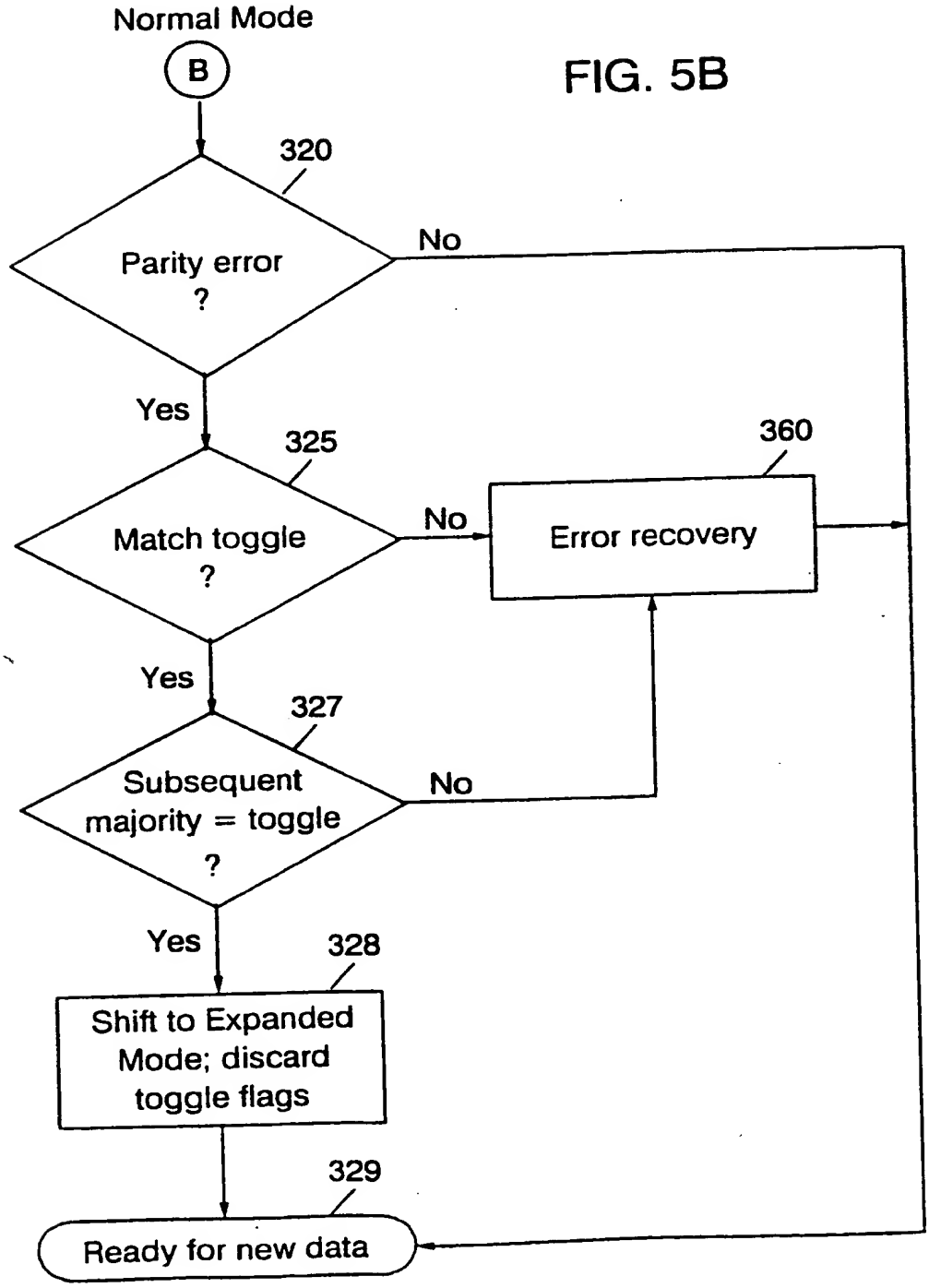

FIG. 5B

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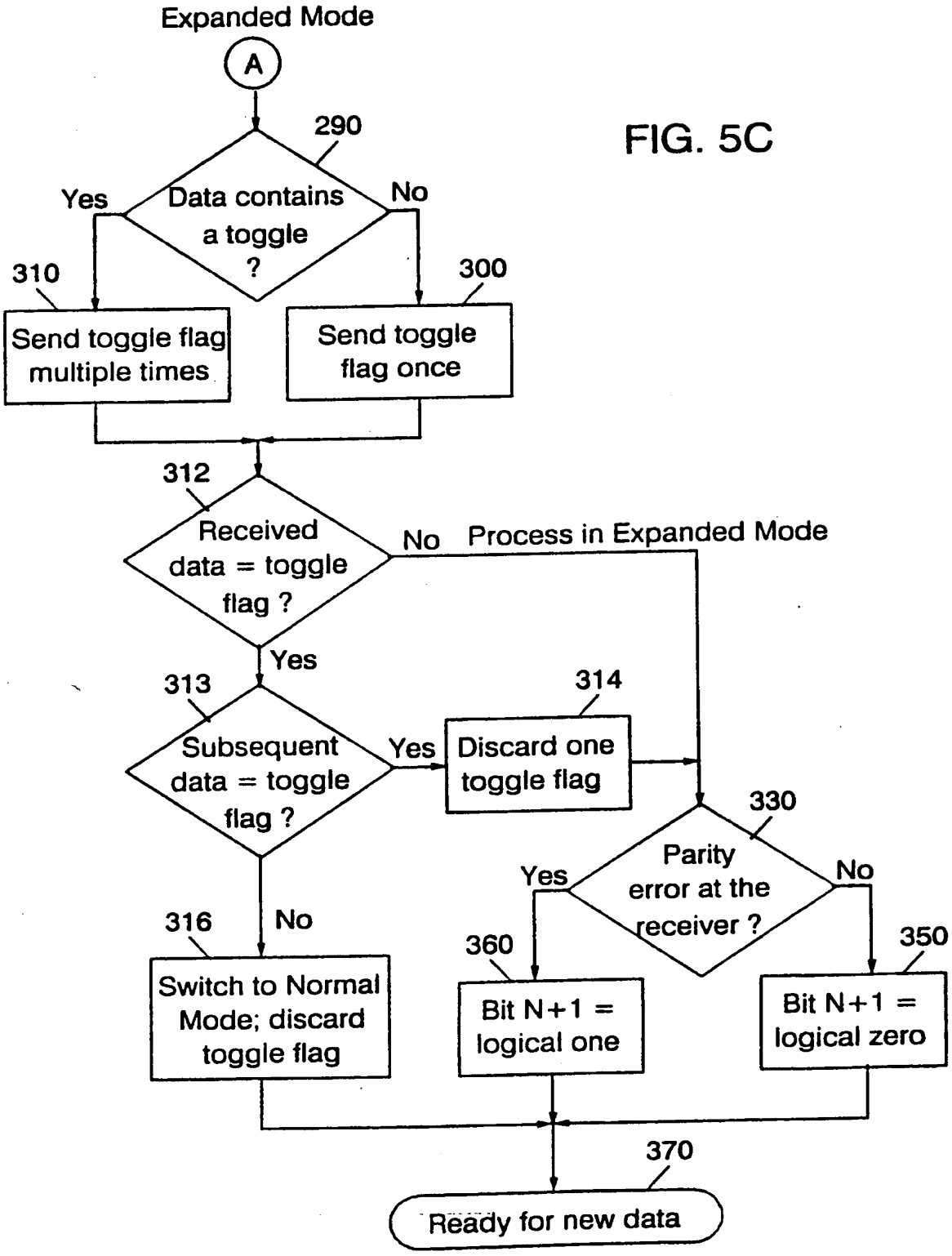

FIG. 5C

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FIG. 6A

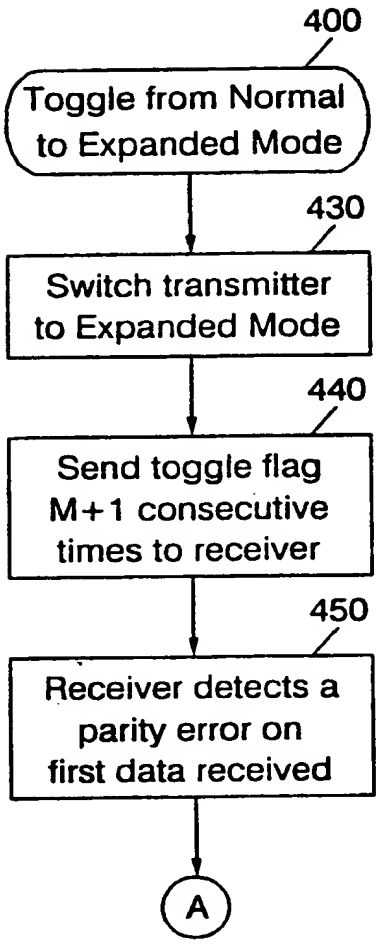
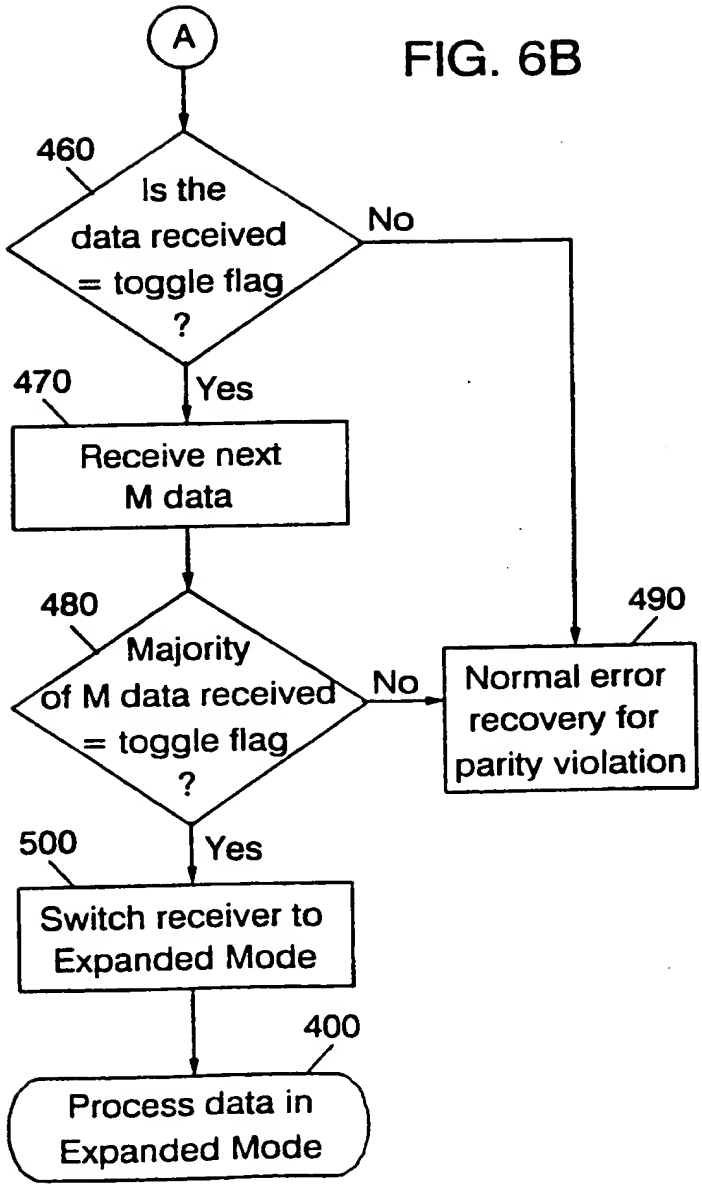


FIG. 6B



BNSDOCID: <WO___9927674A1_I_>

FIG. 7A

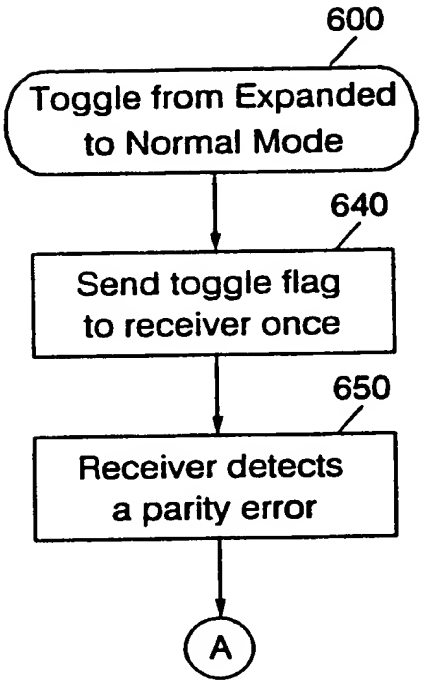
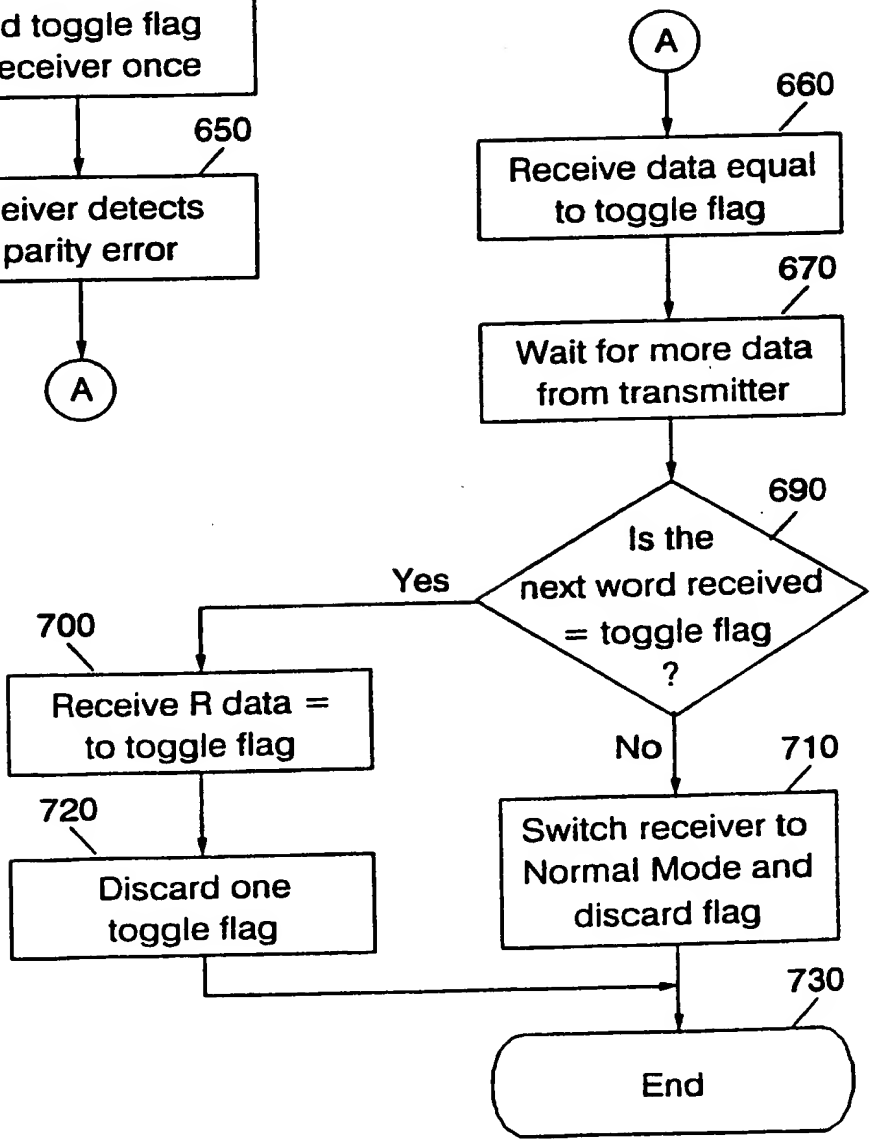


FIG. 7B



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INTERNATIONAL SEARCH REPORT

I. ational Application No
PCT/US 98/21603

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 116 403 A (BRITISH BROADCASTING CORP) 21 September 1983 see abstract see page 1, left-hand column, line 4 - line 12 see page 1, left-hand column, line 23 - line 34 see page 1, left-hand column, line 55 - right-hand column, line 83 see page 2, left-hand column, line 31 - line 40 see figures 1A,1B --- -/--	1,18-21, 24,25, 27,29-32

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 February 1999	22/02/1999

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

I. ational Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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X	US 5 258 999 A (WERNIMONT THOMAS L ET AL) 2 November 1993 see abstract see column 9, line 60 - column 10, line 23 see column 15, line 28 - column 16, line 16 see claim 4	1,18-21, 24,25
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